

Enhanced North American uptake associated with El Niño

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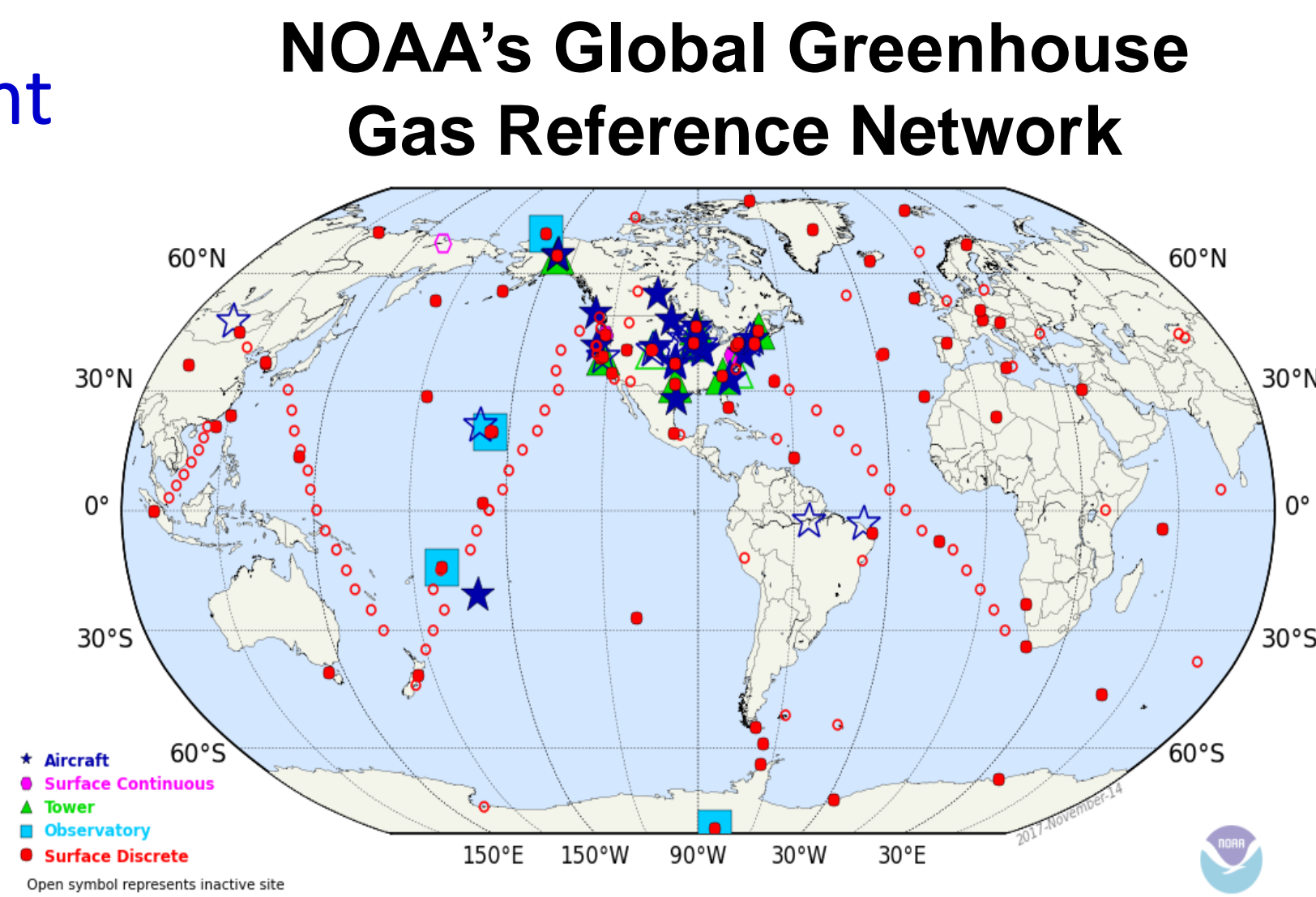
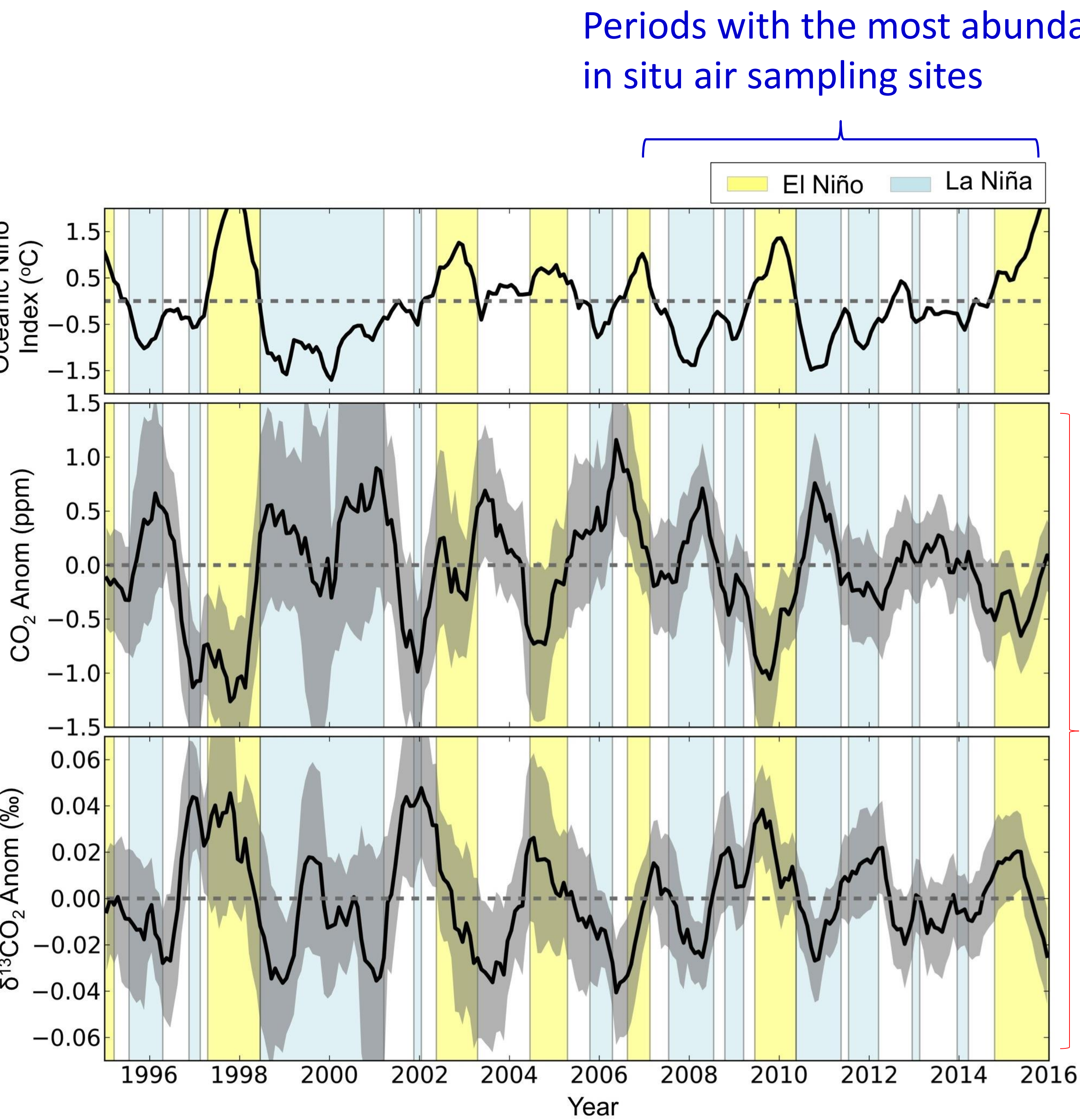


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Significance

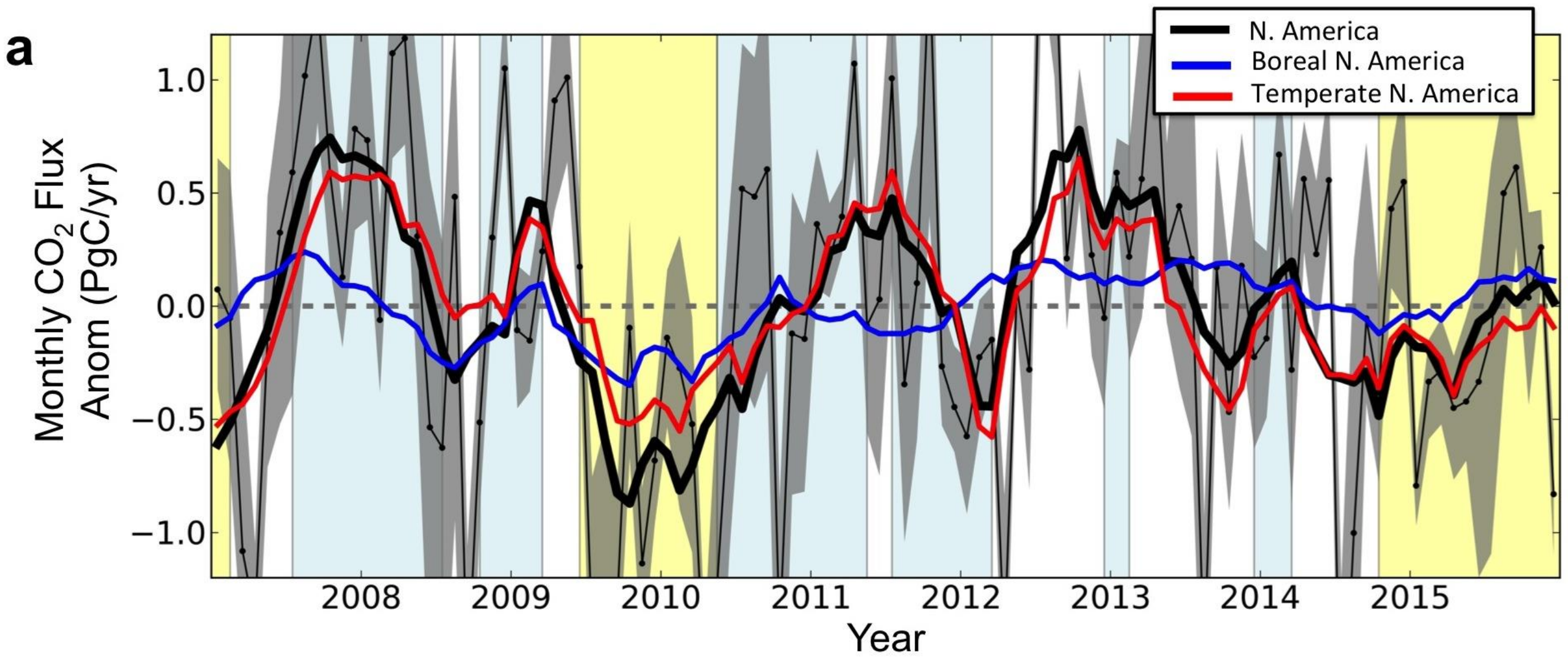
- The impact of the El Niño Southern Oscillation (ENSO) on land carbon uptake was thought primarily over the tropics. **We discovered strong and consistent responses of North American carbon uptake that are opposite to the carbon flux - ENSO relationships observed over the tropical land, highlighting the importance of improving quantification of regional carbon responses to ENSO in order to understand the true climate impact of ENSO.**
- Regional carbon-climate relationships represent a major uncertainty in future climate projections. **This study uses atmospheric observations to identify the dominant climate controls on the variability of North American carbon uptake. Our atmosphere-inferred climate-carbon relationships suggest such relationships have been poorly represented in terrestrial models. Our measurement-based carbon-flux relationships could be used to improve the terrestrial models and future climate projections.**

Observational evidence of North American terrestrial ecosystems to ENSO



Anomalies of atmospheric CO₂ and δ¹³CO₂ averaged across North American air monitoring sites

Large response of North American ecosystems to ENSO



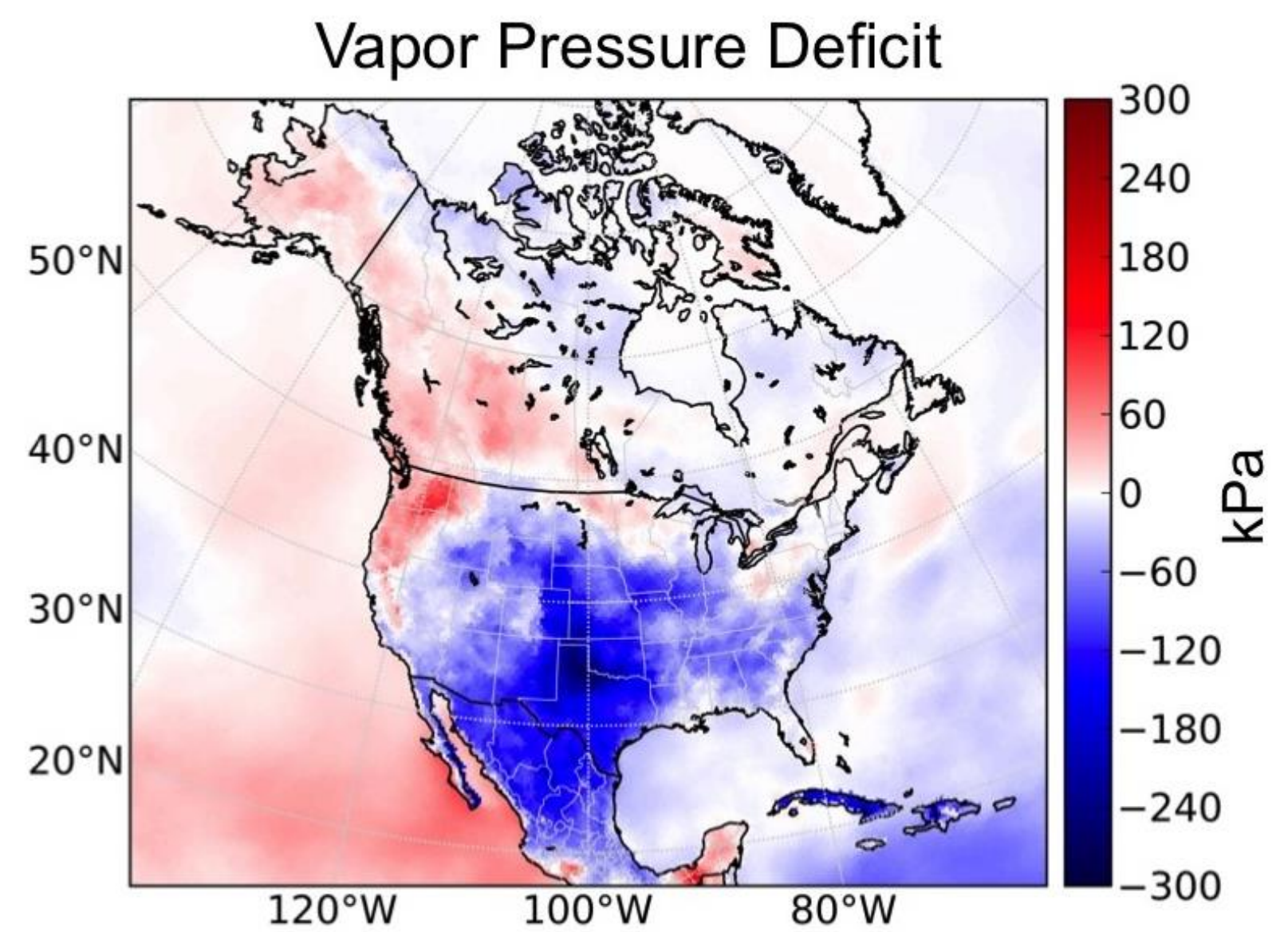
Mean flux anomalies between El Nino and La Nina: -0.61 (-0.45 to -0.79 PgC/yr)
~ = one third total fossil fuel emissions over North America
~ = twice the total U.S. anthropogenic non-CO₂ GHG emissions

Drivers for North American terrestrial ecosystem responses to ENSO

Correlation between yearly anomalies of climate variables and carbon fluxes

Climate Variables	Correlation	
	r	p
Vapor Pressure Deficit	0.75	0.02
Relative Humidity	-0.69	0.04
Soil Moisture	-0.66	0.05
Precipitation	-0.78	0.01
Air Temperature	0.30	0.43

Anomalies of VPD during El Nino compared to La Nina periods



Favorable temperature conditions also contribute to North American ecosystem responses to ENSO

